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ERRATUM

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gas in beverages.

It is well known that the particular gases dissolved in a beverage have a considerable effect on properties of the beverage such as taste and resistance to deterioration. There have been several prior proposals, typified by UK patent 876 628, for dispensing a beverage by providing a mixed gas in solution in the beverage and maintaining a mixed gas pressure in solution by an applied counter-pressure which also acts to deliver the beverage to the consumer. We have now found that there are advantages in dissolving an inert gas in a beverage before it leaves the production plant by injecting the beverage into an inert gas within the container in which the beverage is to be transported from the production plant.

According to the invention there is provided a method for dissolving inert gas (as hereinafter defined) in a beverage which comprises removing air from a container, introducing inert gas into the air-free container and filling the container with the beverage so that the inert gas pressure within the container is in the range 5 to 90 psig. the container being filled with the beverage in such a way that the rising surface of the beverage in contact with the inner gas is maintained in an unbroken condition (as hereinafter defined) for at least 80% of the period during which it is filled with the beverage.

Although the main benefits of using the tensed pressure inside the container. Suitable materials include aluminium, steel, tin plate, glass and plastics material.

The term "inert gas" is used herein to include any gas or mixture of gases that does not adversely affect the beverage. Although the preferred inert gas is nitrogen, other suitable gases include the rare gases (including argon) and hydrogen. The inert gas is preferably sterile.

The term "unbroken" is used herein to indicate a smooth, though not necessarily flat, liquid surface. The rising surface of beverage is preferably maintained in an unbroken condition for at least 90% of the filling period.

The preferred method of making the container air-free is to fill the container with water and then to inject the inert gas so as to drive out the water. Alternatively the container can be flushed with an inert gas or be evacuated by a vacuum pump.

Introduction of beverage into the container can begin as soon as materials other than inert gas have been expelled. Thus introduction of beverage can begin before the pressure has reached 5 psig, provided the introduction of beverage raises the inert gas pressure to above this limit. It is preferred however that the inert gas is at the desired pressure level before introduction of beverage begins. During the introduction of beverage part of the inert gas in the container is dissolved in the beverage. Intro-

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(54) DISSOLVING INERT GAS IN BEVERAGES

(71) We, BOC INTERNATIONAL LIMITED formerly known as THE BRITISH OXYGEN COMPANY LIMITED, of Hammersmith House, London, W6 9DX, England, an English company, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to dissolving inert gas in beverages.

It is well known that the particular gases dissolved in a beverage have a considerable effect on propertics of the beverage such as taste and resistance to deterioration. There have been several prior proposals, typified by UK patent 876 628, for dispensing a beverage by providing a mixed gas in solution in the beverage and maintaining a mixed gas pressure in solution by an applied counter-pressure which also acts to deliver the beverage to the consumer. We have now found that there are advantages in dissolving an inert gas in a beverage before it leaves the production plant by injecting the beverage into an inert gas within the container in which the beverage is to be transported from the production plant.

According to the invention there is provided a method for dissolving inert gas (as hereinafter defined) in a beverage which comprises removing air from a container, introducing inert gas into the air-free container and filling the container with the beverage so that the inert gas pressure within the container is in the range 5 to 90 psig, the container being filled with the beverage in such a way that the rising surface of the beverage in contact with the inner gas is maintained in an unbroken condition (as hereinafter defined) for at least 80% of the period during which it is filled with the beverage.

Although the main benefits of using the method of the invention are found with fermented liquors such as beer it can also be used with advantage for sparkling soft drinks such as lemonade or cola drinks or with sparkling wine.

Suitable containers in which to effect the process of the invention include kegs, barrels, drums, casks, bottles, tanks, carboys, cans and transport tankers. The material of the container must of course be sufficiently strong to withstand the intended pressure inside the container. Suitable materials include aluminium, steel, tin plate, glass and plastics material.

The term "inert gas" is used herein to include any gas or mixture of gases that does not adversely affect the beverage. Although the preferred inert gas is nitrogen, other suitable gases include the rare gases (including argon) and hydrogen. The inert gas is preferably sterile.

The term "unbroken" is used herein to indicate a smooth, though not necessarily flat, liquid surface. The rising surface of beverage is preferably maintained in an unbroken condition for at least 90% of the filling period.

The preferred method of making the container air-free is to fill the container with water and then to inject the inert gas so as to drive out the water. Alternatively the container can be flushed with an inert gas or be evacuated by a vacuum pump.

Introduction of beverage into the container can begin as soon as materials other than inert gas have been expelled. Thus introduction of beverage can begin before the pressure has reached 5 psig, provided the introduction of beverage raises the inert gas pressure to above this limit. It is preferred however that the inert gas is at the desired pressure level before introduction of beverage begins. During the introduction of beverage part of the inert gas in the container is dissolved in the beverage. Intro-

duction of beverage is preferably continued until it fills the container, having driven out any residual inert gas. The pressure within the container can be prevented from rising above the desired level during the introduction of beverage by including a suitable pressure relief valve.

The preferred inert gas pressure in the container during the injection varies from one beverage to another. Thus for beer it is preferably in the range 10 to 30 psig whereas for sparkling soft drinks it is preferably at least 40 psig. For sparkling wine it is preferably at least 30 psig.

The introduction of the beverage is preferably through a dip-tube (or "spear") into the container, the inner end of the tube being not more than 10 mm above the base of the container. Alternatively the beverage can be introduced tangentially so as to run smoothly along the interior wall of the container. Any tendency to allow the liquid surface to break up or to form a spray is to be avoided, since it may change the nature of the beverage.

Because a content of carbon dioxide is built up in most beverages during their manufacturing process the product of the invention contains a mixture of carbon dioxide and inert gas, even though the process of the invention injects inert gas alone. Thus in the case of beer the injection of nitrogen alone easily provides a beverage with a carbon dioxide partial pressure of about 1 atmosphere and an inert gas partial pressure of up to 0.05 atmospheres. Systems requiring the injection of a mixed gas suffer from the drawback of requiring a mixing control panel and a time delay while the gases dissolve in the beverage. According to the invention, once the container is full it is immediately suitable for supply to the consumer.

The smooth filling technique of the present invention reduces both loss of carbon dioxide from the beverage and the formation of undesired foam in the container during the filling process.

Beer dispensed from a container filled according to the invention is found to have a persistent clean creamy head with considerable consumer appeal.

The following example illustrates the invention.

11-gallon aluminium kegs were steam sterilised, filled with water which was then displaced by injecting nitrogen into the kegs to a pressure of 20 psig to drive out the water. Bitter beer containing 1.55 volumes of carbon dioxide and 0.05% nitrogen was injected at a rate of 5 gallons per minute into each keg until there was no residual nitrogen vapour in the keg. Beer dispensed from the keg was found to have a persistent creamy head and contained 1.52 to 1.57 volumes of carbon dioxide and 0.25 to 0.39% of nitrogen.

WHAT WE CLAIM IS:—

1. A method for dissolving inert gas (as hereinbefore defined) in a beverage which comprises removing air from a container, introducing inert gas into the air-free container and filling the container with the beverage so that the inert gas pressure within the container is in the range 5 to 90 psig, the container being filled with the beverage in such a way that the rising surface of the beverage in contact with the inner gas is maintained in an unbroken condition (as hereinbefore defined) for at least 80% of the period during which it is filled with the beverage.

2. A method as claimed in claim 1 wherein the inert gas is nitrogen.

3. A method as claimed in claim 1 wherein the inert gas is argon or hydrogen.

4. A method as claimed in any preceding claim wherein the inert gas is sterile.

5. A method as claimed in any preceding claim wherein the rising surface of the beverage is maintained in an unbroken condition for at least 90% of the filling period.

6. A method as claimed in any preceding claim wherein the container is freed from air by filling the container with water and then injecting the inert gas so as to drive out the water.

7. A method as claimed in any one of claims 1 to 5 wherein the container is freed from air by flushing with an inert gas.

8. A method as claimed in any one of claims 1 to 5 wherein the container is freed from air by evacuation with an air pump and is then flushed with an inert gas.

9. A method as claimed in any preceding claim wherein introduction of beverage into the container is begun before the pressure in the container has reached 5 psig, and the introdnction of beverage raises the inert gas pressure to above 5 psig.

10. A method as claimed in any one of claims 1 to 8 wherein the inert gas in the container is at the desired pressure level before introduction of beverage begins.

11. A method as claimed in any preceding claim wherein introduction of beverage is continued until it fills the container, having driven out any residual inert gas.

12. A method as claimed in any preceding claim, wherein the beverage is introduced through a dip-tube into the container, the inner end of the tube being not more than 10 mm above the base of the container.

13. A method as claimed in any one of claims 1 to 11 wherein the beverage is introduced tangentially so as to run smoothly along the interior wall of the container.

14. A method as claimed in claim 1, substantially as described herein with reference to the example.

15. A beverage whenever treated according to a method according to any preceding claim.

For the Applicants:
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